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Citation	The 2010 CITE Research Symposium on 'e-Learning Design and Designs for Learning', the University of Hong Kong, Hong Kong, 4-6 March 2010.
Issued Date	2010
URL	http://hdl.handle.net/10722/127086
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Chu, S.K.W., Gorman, G.E. & Du, H.S. (2010). Social Bookmarking: An Empirical Analysis of Connotea Users' Perspectives. Paper presented at *CITE Research Symposium 2010*, The University of Hong Kong, Hong Kong.

SOCIAL BOOKMARKING: AN EMPIRICAL ANALYSIS OF CONNOTEA USERS' PERSPECTIVES

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This study examined the perspectives of experienced and inexperienced users of Connotea in terms of reported bookmarking behaviors, perceived usefulness of social bookmarking in information discovery and management, and perceived usefulness of particular Connotea features. A convenience sample of experienced (n=30) and inexperienced users (n=32) responded to an online survey. The questionnaire utilized a 4-point Likert scale to examine the respondents' opinions. The findings showed that both experienced and inexperienced users of Connotea perceived social bookmarking to be useful for information discovery and management. They also perceived the features and policies of Connotea to be useful for their personal purposes. However, the reported frequencies of usage indicated that the extent of use of social bookmarking may not be substantial. Experienced users were also found to use social bookmarking for managing relevant websites while inexperienced users still preferred to use traditional bookmarking in dedicated computers. These findings have potential implications on the development and use of social bookmarking services. Through our results, we provided information on the human factors that may be considered for further improvement of social bookmarking applications.

Keywords: Social bookmarking, Collaborative tagging, Information Management, Information Discovery, Connotea

1. Introduction

When people explore the Internet, one of the challenges they face is remembering and retrieving items that they have previously found to be useful. Whereas the common approach to arranging information on the Web is through the use of personal bookmarks (Millen, Feinberg & Kerr, 2005), the usage of social bookmarking tools may be an alternative solution to overcome this difficulty (Hotho, Jäschke, Schmitz, & Stumme 2006). Social bookmarking or social tagging is a Web 2.0 application that enables users to create shared bookmarks of online resources (Storey, Cheng, Bull, & Rigby, 2006). Users are able to create tags for bookmarks, which are organized such that other users can search and browse through them as well (Godwin-Jones, 2006). Social tagging would refer to the common indexing of objects and resources, which may serve as individual reminders, shared lists, or collective resource library (Panke & Gaiser, 2009). Collaborative tagging has also been used to describe the practice of allowing anyone to attach tags to web contents, which is most useful given the volume of information that is freely available (Golder & Huberman, 2005).

Social bookmarking has been seen to have an increasing popularity in the society (Rainie, 2007). We may infer that this is largely related to the two distinguishing characteristics of social bookmarking systems which refer to its social utility. The first characteristic is the use of keywords or tags that allow users to organize and display a collection of labels that are meaningful to them (Millen, Yang, Whittaker, & Feinberg, 2007). The other important characteristic is that bookmark collections typically become public information that is visible to other people who may use them for their personal purposes (Rader & Wash, 2008). As such, it has been suggested that social bookmarking may be a potentially low-cost application for group information management (Grudin, 2006). It has also been argued that social bookmarking systems provide support for search activities that range from simple fact-finding to more exploratory forms of search (Millen et al., 2007). Exploratory searches are characterized by less defined inquiries that emphasizes on analysis (Marchionini, 2006). Such searches may characterize academic tasks.

Social bookmarking applications have seen the tremendous growth in the past few years, and large organizations have adapted it for use (Millen et al., 2007). There appears to be an immediate popularity in the use of social tagging systems since users require no specific skills to obtain the benefits in terms of organization of information (Jäschke, Hotho, Schmitz, Ganter, & Stumme, 2007). The interest among users, information management professionals, and designers has been phenomenal (Panke & Gaiser, 2009). Research interests has also been raised, and studies have looked into tag growth and entropy (Golder & Huberman, 2006; Kittur et al., 2007), tag choices (Sen et al., 2006), information retrieval methodology or folksonomy (Khalifa & Davis, 2007), and conceptual discussions of the potential academic use of social bookmarking tools (Gordon-Murnane, 2006). Besides such investigations on social bookmarking systems, there is limited empirical evidence about its actual usage and how it is used by people of different backgrounds.

The social bookmarking sites that have gained popularity in the recent years include Del.icio.us, Yahoo's MyWeb, CiteULike, and Connotea. Among these, Connotea [www.connotea.org] is one of the most commonly used social bookmarking systems among online academic users. It was primarily designed for scientists, and manages references and scientific articles (Rethlefsen, 2008). According to reviews by Hammond, Hannay, Lund, and Scott (2005) and Lund, Hammond, Flack, and Hannay (2005), Connotea makes sharing of personal collection of resources much easier than before. Instead of placing materials hierarchically in folders, Connotea allows users to create simple tags to the bookmarks. Tagging allows the organization of bookmarks to be more flexible, multi-faceted and spacious. Since it is a social tool, the references that a Connotea user bookmarks can be made public and shared with colleagues and workgroups across the world (Rethlefsen, 2008).

Despite the promising benefits associated with the use of Connotea for academic purposes, the extent of current research interest on social bookmarking has not examined its use. Not much is known about users' perspectives in social bookmarking systems. Even less is known about its use among those whose purposes are of academic and scientific nature. This research aims to contribute to the growing research body that examines the use of Web 2.0 and social bookmarking in general. We focus on the use of social bookmarking for academic purposes, and thus examine Connotea users. The findings have potential implications on the development and use of social bookmarking services. Through our results, we provide information on the human factors that may be considered for further improvement of social bookmarking applications. Our findings also contribute to further understanding of how social bookmarking may contribute to academic and scientific activities.

Research objectives. The study examines the perspectives of experienced and inexperienced users of Connotea in terms of: (1) reported tagging behaviors, (2) perceived usefulness of social bookmarking in conducting information search, (3) perceived usefulness of social bookmarking for information management, and (4) perceived usefulness of particular Connotea features.

2. Methodology

Participants. A convenience sample of 62 Connotea users participated in this study. Two groups of participants were recruited: (1) experienced and (2) inexperienced users. For the first group, the following were the inclusion criteria: (a) users of Connotea who have created at least 100 bookmarks on the Connotea website, and (b) has made public their email (through their bookmarks) thus allowing a means of contact for recruitment as a study participant. For the second group, the inclusion criteria were: (a) no experience of using Connotea prior to participation in the research, and (b) engaged in academic activities as a part-time or full-time research assistant in the University of Hong Kong. All potential participants were invited by email and informed consent was obtained from each who agreed to join the study. The research procedures were reviewed and approved by the ethics review committee of the university. Table 1 illustrates the academic background of the participants.

Table 1 Academic background of the participants (N=62).

Background	Experienced Users (n=30)	New Users (n=32)
Science and engineering	7	14
Social science and humanities	0	10
General university research/administration	17	3
Business research/administration	1	1
Others	5	4

Survey. The participants were invited to respond to an online survey on www.surveymonkey.com. The questionnaire consisted of close-ended questions that examined their bookmarking and tagging behaviors. The participants' perceptions on the utilities and policies of Connotea were examined using a 4-point Likert scale. Particular attention was directed towards the users' perceptions of using Connotea for information discovery and management. Open-ended questions were also given to allow the participants to expound on their answers when needed.

Procedures. Two separate recruitment procedures were done. For the group of experienced users, From the Connotea website, 76 users who had created 100 or more bookmarks were invited via email to complete the online survey. Thirty respondents were collected from the online survey, with a response rate of 39%. For the group of inexperienced users, 20 research assistants (mostly part-time) and 20 undergraduate students (BSc Information Management) in the university were invited to join the study. With a response rate of 80%, 32 individuals consented to participate in the study. The inexperienced users were asked to register for an account in Connotea and use the application for at least two months. At the end of the two months, the new users were asked to answer the online questionnaire.

Data Analysis. Responses to the online questionnaire were retrieved and analyzed using SPSS 17.0. The questionnaire included a 4-point Likert scale to examine the respondents' opinions, where 1 referred to "Strongly disagree" and 4 denoted "Strongly agree". For the ratings with the 4-point scale, 2.5 denotes neutral, ratings > 2.5 are positive, whereas those < 2.5 are negative responses on the issues. Descriptive statistic was used to characterize the users' perspectives in using Connotea. The Mann-Whitney test was used to examine differences when comparing the two user groups. Statistical Significance was set at $p < 0.05$.

3. Results

Users' behaviors and perceptions on bookmarking and tagging: Table 1 shows the bookmarking frequencies of the participants. Apparently, experienced users made use of the bookmarks and tags more frequently than inexperienced users. However, a statistically significant difference was observed between the user groups only in the frequency of creating bookmarks. Experienced users on an average created bookmarks once every week while most of the inexperienced users created bookmarks only once a month or less. Among all the users,

using bookmarks that were personally created appeared to be done more often than copying bookmarks from other users, and sharing bookmarks with collaborators.

Table 1 Bookmarking behaviors of Connotea users.

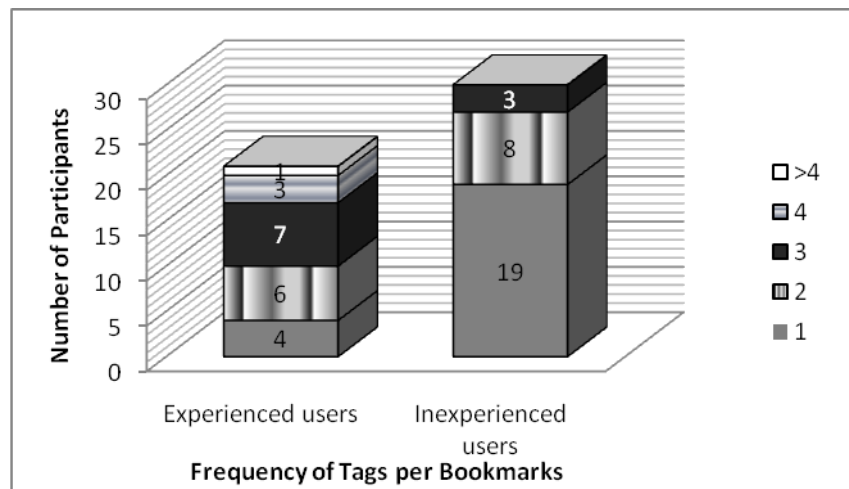
Bookmarking Frequency	Experienced Users Mean (SD)	Inexperienced Users Mean (SD)	Mann-Whitney Significance (<i>p</i>)
Creating bookmarks	3.31(1.365) ^a	2.53(0.983) ^d	0.012 [*]
Copying bookmarks from other users	1.68(0.670) ^b	1.63(0.609) ^d	0.804
Using bookmarks personally created	2.68(1.219) ^b	2.31(0.931) ^d	0.277
Sharing bookmarks with collaborators	1.85(1.231) ^c	1.75(0.762) ^d	0.703
Creating tag notes	2.07(1.252) ^a	1.94(0.759) ^d	0.846

Notes: ^{*}statistically significant at $p < 0.05$

^a $n = 29$, ^b $n = 28$, ^c $n = 27$, ^d $n = 32$

1 – Never, 2 – Once a month or less, 3 – Once every 2 weeks, 4 – 1-2 times a week, 5 – 3-6 times a week, 6 – Once every day or more

Figure 1 shows the tagging frequencies of the participants. While the majority of experienced users created two or three tags per bookmark in Connotea, most of the inexperienced ones created only one tag per bookmark. The difference in the tagging behaviors between the user groups was statistically significant ($p = 0.000$).



Notes: The presented data are from participants who responded to this question (experienced users $n = 21$; inexperienced users $n = 30$).

Figure 1 Number of tags per bookmark reported by Connotea users.

Table 2 shows the users' perceptions on the usefulness of bookmarks and tags for different aspects. Some of the participants gave the response of "Don't know" for some of the criteria and these were excluded in the analysis. Thus the criteria respondents have different sample sizes.

Table 2 Users' perceptions on the usefulness of bookmarks and tags.

Criterion	Experienced Users Mean (SD)	Inexperienced Users Mean (SD)	Mann-Whitney Significance (<i>p</i>)
It is useful to create a title for a bookmark	2.80 (1.033) ^a	3.03 (0.556) ^g	0.522
It is useful to use tags in finding relevant bookmarks created by other Connotea users	3.00 (1.000) ^b	2.90 (0.759) ^g	0.821
It is useful to use tags to find your own bookmarks	3.80 (0.422) ^a	3.07 (0.583) ^g	0.001*
It is useful to form a group with friends or colleagues for sharing bookmarks	2.86 (0.690) ^c	2.80 (0.610) ^g	0.842
It is useful to use tags in sharing bookmarks with friends or colleagues	3.31 (0.855) ^d	2.73 (0.583) ^g	0.006*
It is useful to create tag notes in Connotea	3.11 (0.937) ^e	3.04 (0.611) ^h	0.201
It is a good policy that Connotea requires its users to create at least one tag per bookmark	3.00 (1.155) ^f	2.88 (0.612) ⁱ	0.425

Notes: *statistically significant at $p < 0.05$

^a*n* = 10, ^b*n* = 5, ^c*n* = 7, ^d*n* = 13, ^e*n* = 16, ^f*n* = 19, ^g*n* = 30, ^h*n* = 24, ⁱ*n* = 25

Participants gave ratings based on a 4 - point Likert scale where 1 = "Strongly disagree", and 4 = "Strongly agree"

Generally speaking, the participants had positive perceptions on the usefulness of bookmarks and tags for different purposes. For both experienced and inexperienced users, they gave the highest rating to the use of tags in finding users' own bookmarks. This result appears to be consistent with the positive perception from the users on the Connotea policy that users have to create at least one tag per bookmark. Users perceived it as a good policy as it would be convenient for users to find relevant bookmarks and organize them. It is noted that the criteria which refer to using bookmarks and tags with friends or colleagues had the lowest rating among all criteria for inexperienced users. This appears to be consistent with the earlier finding that users copied bookmarks from others and shared bookmarks with their collaborators less often. However, even though experienced users also showed a low frequency of using bookmarks and tags with their collaborators, they perceived the use of tags in sharing bookmarks with friends or colleagues as a relatively useful feature in Connotea.

The usefulness of tags in different aspects, in general, had higher ratings from experienced users than inexperienced users. Differences in ratings were statistically significant for the criteria on using tags to find their own, and to share bookmarks with colleagues. This may relate to the earlier finding that experienced users created more tags per bookmark than inexperienced users, as experienced users had a perception that tagging was indeed useful.

Information Discovery: The participants rated the usefulness of the particular functions of Connotea in terms of information discovery. The results are summarized in Tables 3 and 4. Both groups of users agreed that the automatic collection of bibliographic information is useful and easy to use. However, some users commented that the limitation of the automatic collection is that Connotea is inconsistent with the recognition of the reference of an article, resulting in additional time to correct the information.

Table 3 Users' perception on automatic collection of bibliographic information.

Statement	Experienced Users Mean (SD)	Inexperienced Users Mean (SD)	Mann-Whitney Significance (<i>p</i>)
It is useful	3.39 (0.850) ^a	3.17 (0.491) ^c	0.098
It is easy to use	2.95 (0.848) ^b	2.71 (0.772) ^d	0.264

Notes: ^a*n* = 18, ^b*n* = 19, ^c*n* = 23, ^d*n* = 17

Participants gave ratings based on a 4 - point Likert scale where 1 = "Strongly disagree", and 4 = "Strongly agree"

Questions regarding the usefulness of search box and some other Connotea functions for information discovery were also included in the questionnaire. The users' views on the above methods of finding information in Connotea are summarized in Table 4. The ratings were positive for most of the methods, showing that participants found some specific Connotea functions useful to support information discovery.

Table 4 Users' perception on the usefulness of different methods of finding information in Connotea.

Methods	Experienced Users Mean (SD)	Inexperienced User Mean (SD)	Mann-Whitney Significance (<i>p</i>)
Using the search box with the choice "This Collection"	2.94 (0.929) ^a	3.05 (0.669) ^e	0.945
Using the search box with the choice "My Library"	3.16 (0.958) ^b	3.08 (0.717) ^f	0.483
Using the search box with the choice "All"	2.89 (0.875) ^b	2.88 (0.680) ^g	0.843
Using the search box with the choice "Find Exact Tag"	3.11 (0.737) ^b	2.74 (0.810) ^g	0.097
Using the search box with the choice "Find Exact User"	2.60 (0.828) ^c	2.67 (0.856) ^e	0.744
Using the search box with the choice "Find Exact URL"	2.13 (0.834) ^c	2.58 (1.121) ^h	0.182
Using "Related Tags"	2.89 (1.023) ^d	2.96 (0.767) ^g	0.955
Using "Related Users"	2.94 (1.110) ^d	2.65 (0.832) ^g	0.297
Through other Connotea users who have similar interests	3.00 (0.894) ^a	3.05 (0.575) ^h	0.947

Notes: ^a*n* = 16, ^b*n* = 19, ^c*n* = 15, ^d*n* = 18, ^e*n* = 21, ^f*n* = 24, ^g*n* = 23, ^h*n* = 22

1 – Not Useful, 2 – A Bit Useful, 3 – Useful, 4 – Very Useful

In general, there were no significant differences in the participants' views on different methods to find information in Connotea. From both groups of participants, the use of the search box with the choice "My Library" received the highest rating, consistent with previous findings that users have preference on using Connotea for personal purpose. Finding

information through other Connotea users with similar interests also received a relatively high rating, as commended by some users that this can save time from screening relevant information and bookmarks. The function that received the lowest rating from both groups was the use of the search box with the choice “Find Exact URL”.

Among the methods listed, the use of search box with the choice “Find Exact Tag” received relatively higher ratings from experienced users than inexperienced users, though the difference is not significant ($p = 0.097$). This appears to be consistent with earlier findings that the use of tags in finding and sharing bookmarks were regarded as more useful by the experienced users. This related further to the higher tagging frequency per bookmark among experienced users.

Information management: The use of Connotea for personal and group information management was also examined, and results are shown in Table 5. It appears that both user groups found Connotea to be easy and useful in personal and group information management. No significant differences in the groups’ perceptions were found. The inexperienced users gave the lowest ratings to the ease of sharing bookmarks with others. It may be noted in the preceding sections that inexperienced users also gave lower ratings on the usefulness of tags in sharing bookmarks.

An interesting finding is that experienced users gave higher ratings to the use of Connotea for group information management compared to personal information management. The previous sections have so far showed that experienced users had a higher frequency of using bookmarks created personally, as well as a relatively lower frequency of sharing bookmarks with collaborators. There seems to be some degree of inconsistency in the experienced users’ perceptions, which implies that further inquiries on their perceived information management use might be necessary.

Table 5 Users’ perceptions on the use of Connotea for information management.

Criterion	Experienced Users Mean (SD)	Inexperienced Users Mean (SD)	Mann-Whitney Significance (p)
<i>Personal Information Management</i>			
It is quick to create bookmarks	3.16 (0.688) ^a	3.21 (0.738) ^d	0.727
It is easy to save bookmark	3.16 (0.688) ^a	3.19 (0.483) ^e	0.854
Connotea is useful for managing personal information	2.89 (0.737) ^a	3.04 (0.706) ^f	0.467
<i>Group Information Management</i>			
It is easy to share bookmarks with others	3.00 (0.679) ^b	2.81 (0.602) ^g	0.230
Connotea is useful for managing information in a group	3.18 (0.728) ^c	3.05 (0.394) ^h	0.225

Notes: ^a $n = 19$, ^b $n = 14$, ^c $n = 17$, ^d $n = 28$, ^e $n = 27$, ^f $n = 23$, ^g $n = 22$, ^h $n = 21$

Participants gave ratings based on a 4 - point Likert scale where 1 = “Strongly disagree”, and 4 = “Strongly agree”

Other Connotea features: The participants also reported various Connotea features that they found useful, and the findings are shown in Table 6. Accessing references and bookmarks from any computer was reported useful by the most number of participants. Exporting references and bookmarks to Endnotes or other desktop reference managers was reported to be useful by the least number of participants. Majority of the experienced users also found the automatic recognition and filing of references, as well as sharing references and bookmarks to be useful. In contrast, less inexperienced users found these useful.

Table 6 Users' perception on various Connotea features.

Feature	Experienced Users	Inexperienced Users
Recognizing reference and automatically filling in bibliographic information	68.42%	30.00%
Sharing reference/bookmarks among all Connotea users	52.63%	36.67%
Accessing your reference/bookmarks from any computer	73.68%	80.00%
Exporting your reference/bookmarks to Endnote or other desktop reference managers	26.32%	16.67%

Notes: The presented data are from participants who responded to this question (experienced users $n=19$; inexperienced users $n=30$). Users can pick all those features that he/she finds useful. So the total percentage is the number of users who have picked this feature over the total number of respondents.

Overall perception: Table 7 shows the users' overall perceptions on using Connotea as compared to the usual bookmarking methods on a dedicated computer. Experienced users gave more positive ratings, with a significantly higher rating for using social bookmarking websites instead of the typical bookmarking methods ($p = 0.000$). It also appears that the experienced users eventually managed useful websites through social bookmarking services more often than the traditional bookmarking methods. This finding is illustrated in Table 8.

Table 7 Users' perception on Connotea and traditional way of saving bookmarks.

Statement	Experienced Users Mean (SD)	Inexperienced Users Mean (SD)	Mann-Whitney Significance (p)
I enjoy using Connotea	3.06 (0.748) ^a	2.69 (0.736) ^c	0.079
Using social bookmarking websites like Connotea to save bookmarks is better than using the traditional way of saving bookmarks into a dedicated computer	3.74 (0.452) ^b	2.76 (0.926) ^d	0.000

Notes: ^a $n=17$, ^b $n=19$, ^c $n=26$, ^d $n=25$

Participants gave ratings based on a 4 - point Likert scale where 1 = "Strongly disagree", and 4 = "Strongly agree"

Table 8 Users' methods of managing useful websites.

Method	Experienced Users	Inexperienced Users
Bookmarking websites on a computer	31.58%	83.33%
Using Connotea	57.89%	23.33%
Using other social bookmarking sites	68.42%	13.33%
Adding them to your own website	5.26%	3.33%

4. Discussion

The popularity of social bookmarking systems is believed to be associated with its potential for improving online information search (Yanbe, Jatowt, Nakamura, & Tanaka, 2007). This study aimed to examine if indeed, the potential benefits that appear to be linked with social bookmarking are perceived by experienced and inexperienced users. In order to focus on academic users, Connotea was used as the online platform in this research. Our findings showed that academic users' perceptions of a social bookmarking system confirm its usefulness for information discovery and information management. The particular features afforded by Connotea were also perceived to be useful. The findings of this study form a relevant contribution in understanding the use of social bookmarking systems, as it provides empirical data coming from the users themselves.

Besides the general positive perceptions of the users, the study also provided some insights on the extent of usefulness of social bookmarking. Many believe that social bookmarking has the potential to change how users access digital information ("Tagging: The next big thing," 2005). However, our findings show that even when the users have positive perceptions on social bookmarking, their reported usage do not appear to be substantial. This is illustrated in the frequency of bookmarking where the users reported no more than a frequency of twice per week. Furthermore, bookmarking behaviors appear to be focused on creating bookmarks, and less on sharing them with collaborators. This is contrary to the collaborative nature of social bookmarking that has been described as one of its important features (Golder & Huberman, 2005). Our findings further showed that collaborative tagging does not occur frequently among academic users of social bookmarking service. This contradicts the collaborative potentials of social bookmarking, and the users gave low ratings for the usefulness of bookmarks in sharing information with their colleagues.

It must also be noted that even when the mean ratings as shown in the results are all on the positive side, the standard deviations are rather high. This implies that the users' perceptions are varied, where a number of people have both highly positive and highly negative responses. Furthermore, not all respondents actually had opinions on all the criteria that were given to them. We reported that the sample sizes for the different items in the questionnaire vary. A number of participants – both experienced and inexperienced ones – reported that they did not know whether the particular features were indeed useful. These findings suggest

that a generally positive regard for social bookmarking is present among users, but this is not consistent enough to serve as evidence to say that it has a significant impact on the way users search and manage information.

The users' preferences for methods of managing useful websites showed that those who are more experienced utilized social bookmarking sites, including Connotea. On the other hand, majority of the inexperienced users bookmarked websites on their dedicated computers. This appears to be a logical finding, which highlights the impact of time exposure to a technology. The experienced users who have been using the social bookmarking websites longer may have had enough time to actually take that shift towards using the new technology; whereas, the inexperienced users may still need more exposure to the use of Connotea for them to gain adequate familiarity and comfort with the method.

Limitations. We also acknowledge certain limitations in this study. For some analysis, the sample sizes are small, that is because some of the participants did not give responses to those questions. Given the limited sample size, a follow-up study may be needed to ascertain the users' perceptions on the usefulness of Connotea. Clarifications were also obtained from the participants through open-ended questions, however no qualitative analysis have been done yet. Nevertheless, these serve as basis for the next study which will seek to gain further qualitative information.

5. Conclusion and recommendations

The findings of this study show that the bookmarking behaviours of Connotea users were mostly in the creation of bookmarks and using bookmarks that they personally created. The frequency of copying and sharing bookmarks with their colleagues was noted to be less frequent. These findings indicate that the collaborative potentials of social bookmarking services do not seem to be utilized fully by both experienced and inexperienced users of Connotea.

Both experienced and inexperienced users of Connotea perceived social bookmarking to be useful for information discovery. They also perceived Connotea to be useful in both personal and group information management. The particular feature of Connotea that the users found to be most useful was the ability to access references and bookmarks from any computer. The function of automatic recognition and filing of references, and sharing references/bookmarks with other users was also found useful by experienced users.

There were generally less positive perceptions on the use of Connotea for collaborative tagging, and the reported frequencies of usage indicated that the extent of use of social bookmarking may not be substantial. This implies that users may have positive perceptions of social bookmarking, but this does not mean that they are actually using it to its full potential. Furthermore, the extent of experience in using Connotea does not seem to influence the users' perceptions of its usefulness. On the other hand, the actual use of social bookmarking

services for managing useful websites is influenced by the amount of experience. We found that experienced users of Connotea utilized social bookmarking services for managing websites, while inexperienced users preferred the traditional bookmarking in their dedicated computers.

Our findings showed a number of important factors in the perspectives of users of Connotea. We highlighted the disparity in the positive perceptions of the usefulness of social bookmarking with the actual reported usage. This indicates the need for further studies that will seek to explain the factors related to actual usage of social bookmarking. Follow-up research may also seek to examine the optimum amount of usage experience which will facilitate users to use social bookmarking more than the traditional dedicated computer bookmarking.

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